

Serial No. 09/910,497
Response dated August 18, 2005
Reply to Office Action of April 19, 2005

Docket No.: 290397.0007

Amendments to the Claims:

1. (currently amended) A diol based, reduced toxicity, non-aqueous heat transfer fluid, having a freezing point at atmospheric pressure of less than minus 10°C and a boiling point at atmospheric pressure of greater than 150°C, for use in a heat exchange system without any addition of water, said heat transfer fluid comprising:

(a) a first diol consisting of ethylene glycol, wherein the ethylene glycol comprises more than 60 percent by weight of the total weight of diols in the heat transfer fluid;

(b) at least one second diol, wherein the second diol acts as an inhibitor for ethylene glycol poisoning when it is mixed with ethylene glycol, ~~and wherein the second diol has a boiling point above approximately 150°C;~~ and

(c) at least one corrosion inhibitor additive that is soluble in the first and second diols, wherein the heat transfer fluid contains no additives that require water to be present in the fluid to dissolve the additives or to otherwise enable the additives to function.

2. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor additive is selected from the group consisting of a molybdate salt, a nitrate salt and an azole.

3. (original) The heat transfer fluid of claim 1, wherein the diols comprise from about 85 percent by weight to about 99.85 percent by weight of the heat transfer fluid.

4. (original) The heat transfer fluid of claim 1, wherein the second diol is propylene glycol.

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5. (cancelled) ~~The heat transfer fluid of claim 1, wherein propylene glycol comprises from about 30 percent by weight to about 100 percent by weight of the total weight of the diols, and ethylene glycol comprises from about 0 percent by weight to about 70 percent by total weight of the total weight of the diols.~~

6. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor is comprised of a molybdate salt in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.

7. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor is comprised of a nitrate salt in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.

8. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor is comprised of an azole in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.

9. (original) The heat transfer fluid of claim 6, wherein the molybdate salt is sodium molybdate.

10. (original) The heat transfer fluid of claim 7, wherein the nitrate salt is sodium nitrate.

11. (original) The heat transfer fluid of claim 8, wherein the azole is tolyltriazole.

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12. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor is comprised of at least one of (i) sodium molybdate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, (ii) sodium nitrate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, and (iii) tolyltriazole in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid.

13. (original) The heat transfer fluid of claim 1, wherein

(a) ethylene glycol comprises about 70 percent by weight of the total weight of diols in the heat transfer fluid;

(b) propylene glycol comprises about 30 percent by weight of the total weight of diols in the heat transfer fluid;

(c) sodium molybdate comprises about 0.5 percent by weight of the total weight of the heat transfer fluid;

(d) sodium nitrate comprises about 0.5 percent by weight of the total weight of the heat transfer fluid; and

(e) tolyltriazole comprises about 0.5 percent by weight of the total weight of the heat transfer fluid.

14. (cancelled) ~~A diol based, reduced-toxicity, non-aqueous heat transfer fluid for use in a heat exchange system without addition of water comprising at least one diol having a~~

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~~boiling point above approximately 150°C, and means for providing an inhibitor for ethylene glycol poisoning when it is mixed with ethylene glycol.~~

15. (cancelled) ~~The heat transfer fluid of claim 14, wherein the ethylene glycol poisoning inhibitor is propylene glycol.~~

16. (cancelled) ~~The heat transfer fluid of claim 14, further comprising at least one corrosion inhibitor additive that is soluble in the diols in the heat transfer fluid.~~

17. (cancelled) ~~The heat transfer fluid of claim 16, wherein the corrosion inhibitor additive is selected from the group consisting of a molybdate salt, a nitrate salt and an azole.~~

18. (cancelled) ~~The heat transfer fluid of claim 16, wherein the diols comprise from about 85 percent by weight to about 99.85 percent by weight of the heat transfer fluid.~~

19. (cancelled) ~~The heat transfer fluid of claim 16, wherein the corrosion inhibitor is comprised of a molybdate salt in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.~~

20. (cancelled) ~~The heat transfer fluid of claim 16, wherein the corrosion inhibitor is comprised of a nitrate salt in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.~~

21. (cancelled) ~~The heat transfer fluid of claim 16, wherein the corrosion inhibitor is comprised of an azole in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.~~

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22. (cancelled) ~~The heat transfer fluid of claim 19, wherein the molybdate salt is sodium molybdate.~~

23. (cancelled) ~~The heat transfer fluid of claim 20, wherein the nitrate salt is sodium nitrate.~~

24. (cancelled) ~~The heat transfer fluid of claim 21, wherein the azole is tolyltriazole.~~

25. (cancelled) ~~The heat transfer fluid of claim 16, wherein the corrosion inhibitor is comprised of at least one of sodium molybdate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, sodium nitrate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, or tolyltriazole in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid.~~

26. (cancelled) ~~The heat transfer fluid of claim 14, wherein at least one diol is ethylene glycol.~~

27. (currently amended) A method to reduce the toxicity of an ethylene glycol based, non-aqueous heat transfer fluid comprising the steps of:

- (a) providing an ethylene glycol based heat transfer fluid; and
- (b) adding a sufficient amount of a diol that acts as an inhibitor for ethylene glycol poisoning when it is mixed with ethylene glycol to reduce the toxicity of the heat transfer

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fluid, wherein the ethylene glycol concentration of the resulting heat transfer fluid is more than 60 percent by weight of the total weight of the diols in the heat transfer fluid.

28. (currently amended) The method of claim 27, wherein the diol that acts as an inhibitor for ethylene glycol poisoning comprises at least about 30 percent by weight of the weight of the diols in the heat transfer fluid.

29. (previously presented) The method of claim 28, wherein the diol that acts as an inhibitor for ethylene glycol poisoning is propylene glycol.

30. (withdrawn) A method for cooling an internal combustion engine having a liquid based cooling system including at least one cooling chamber, at least one heat exchanger and at least one pump for circulating a heat transfer fluid, using a reduced toxicity, non-aqueous ethylene glycol based heat transfer fluid, said method comprising the steps of:

(a) substantially filling the cooling system with a non-aqueous heat transfer fluid comprising (1) ethylene glycol and (2) a sufficient amount of a diol that acts as an inhibitor to ethylene glycol poisoning when it is mixed with ethylene glycol to reduce the oral toxicity of the heat transfer fluid; and

(b) pumping the heat transfer fluid through the cooling system such that the heat transfer fluid absorbs heat in the cooling chamber that is produced by the internal combustion engine and releases the absorbed heat to the atmosphere through the heat exchanger.

31. (withdrawn) The method of claim 30, wherein the diol that acts as an inhibitor to ethylene glycol poisoning when it is mixed with ethylene glycol is propylene glycol.

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32. (withdrawn) The method of claim 31, wherein the propylene glycol comprises at least 30 percent by weight of the ethylene glycol and propylene glycol in the heat transfer fluid.

33. (withdrawn) The method of claim 31, wherein the heat transfer fluid further comprises at least one corrosion inhibitor additive that is soluble in ethylene glycol and propylene glycol.

34. (withdrawn) The method of claim 33, wherein the corrosion inhibitor additive is selected from the group consisting of a molybdate salt, a nitrate salt and an azole.

35. (withdrawn) A method for cooling a heat generating device having a liquid based cooling system including at least one cooling chamber, at least one heat rejection apparatus and at least one pump for circulating a heat transfer fluid, using a reduced toxicity, non-aqueous ethylene glycol based heat transfer fluid, said method comprising the steps of:

(a) substantially filling the cooling system with a non-aqueous heat transfer fluid comprising (1) ethylene glycol and (2) a sufficient amount of a diol that acts as an inhibitor to ethylene glycol poisoning when it is mixed with ethylene glycol to reduce the oral toxicity of the heat transfer fluid; and

(b) pumping the heat transfer fluid through the cooling system such that the heat transfer fluid absorbs heat in the cooling chamber that is produced by the heat generating device and releases the absorbed heat to the atmosphere through the heat rejection apparatus.

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36. (withdrawn) The method of claim 35, wherein the diol that acts as an inhibitor to ethylene glycol poisoning when it is mixed with ethylene glycol is propylene glycol.

37. (withdrawn) The method of claim 36, wherein the propylene glycol comprises at least about 30 percent by weight of the ethylene glycol and propylene glycol in the heat transfer fluid.

38. (withdrawn) The method of claim 36, wherein the heat transfer fluid is further comprises at least one corrosion inhibitor additive that is soluble in ethylene glycol and propylene glycol.

39. (withdrawn) The method of claim 38, wherein the corrosion inhibitor additive is selected from the group consisting of a molybdate salt, a nitrate salt and an azole.

40. (currently amended) The method of claim 29, further comprising the step of adding to the non-aqueous heat transfer fluid a corrosion inhibitor additive that is soluble in both ethylene glycol and the diol that acts as an inhibitor for ethylene glycol poisoning, wherein the heat transfer fluid contains no additives that require water to be present in the fluid to dissolve the additives or to otherwise enable the additives to function.

41. (previously presented) The method of claim 40, wherein the corrosion inhibitor is selected from the group consisting of a molybdate salt, a nitrate salt, and an azole.

42. (previously presented) The method of claim 29, wherein the diols comprise from about 85 percent by weight to about 99.85 percent by weight of the heat transfer fluid.

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43. (currently amended) The method of claim 29, wherein ethylene glycol comprises ~~up to about 70~~ more than 60 percent by weight and propylene glycol comprises ~~more~~ less than ~~about 30~~ 40 percent by weight of the total weight of the ethylene glycol and the propylene glycol in the fluid.

44. (previously presented) The method of claim 40, wherein the corrosion inhibitor comprises a molybdate salt in a concentration of between about 0.05 percent to about 5 percent of the weight of the heat transfer fluid.

45. (previously presented) The method of claim 40, wherein the corrosion inhibitor comprises a nitrate salt in a concentration of between about 0.05 percent to about 5 percent of the weight of the heat transfer fluid.

46. (previously presented) The method of claim 40, wherein the corrosion inhibitor comprises an azole in a concentration of between about 0.05 percent to about 5 percent of the weight of the heat transfer fluid.

47. (previously presented) The method of claim 44, wherein the molybdate salt is sodium molybdate.

48. (previously presented) The method of claim 45, wherein the nitrate salt is sodium nitrate.

49. (previously presented) The method of claim 46, wherein the azole is tolyltriazole.

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50. (previously presented) The method of claim 40, wherein the corrosion inhibitor comprises at least one of (i) sodium molybdate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, (ii) sodium nitrate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, and (iii) tolyltriazole in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid.